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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/905,027	07/13/2001	Harold G. Craighead	1153.032US1	2231

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EXAMINER

COTHORN, JUDITH A

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 08/29/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/905,027

Applicant(s)

CRAIGHEAD ET AL.

Examiner

Judith A. Cothorn

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24 is/are allowed.
- 6) ☒ Claim(s) 1-23 and 25-39 is/are rejected.
- 7) ☐ Claim(s) 29-40 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

This office action is in response to the filing of the application on 07/13/01.

Claim Objections

1. Claims 29-40 are objected to because of the following informalities: The numbering of the claims is incorrect because claim number 29 is missing. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 5-19 and 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5 recites the limitation "said dielectric floor layer" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim 8 recites the limitation "said dielectric ceiling layer" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claims 9, 16, and 18 recite the limitation "said second sacrificial layer" in line 4 of claim 9, line 2 of claim 16, and lines 1-2 of claim 18. There is insufficient antecedent basis for this limitation in the claims.

Claim 17 recites the limitation "said first and second dielectric ceiling layers" in line 1 of claim 17. There is insufficient antecedent basis for this limitation in the claim.

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Claim 23 is rendered indefinite because the claim states "depositing a thin film of conformal sacrificial layer on said substrate and sidewall, ...removing by an unmasked RIE the thin film sacrificial layer on the sidewall and on the substrate..." in lines 3-7 of claim 23. It is unclear as to how the sacrificial wire along the base of the sidewall is to be formed if the sacrificial wire is also the sacrificial layer that is removed.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-2, 20-22, and 25-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Mastrangelo et al. (6,136,212).

In re claims 1, 25, and 26, Mastrangelo et al disclose a method comprising the steps of: depositing a floor layer on the top surface of a substrate (column 5, lines 57-66); depositing a sacrificial layer on the top surface of said floor layer (column 5, line 67-column 6, line 3); patterning said sacrificial layer to define in the sacrificial layer the

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shape of a desired fluid working gap (column 5, line 67-column 6, line 3); depositing a ceiling layer to cover said sacrificial layer (column 6, lines 3-5); and removing said sacrificial layer from between said floor layer and said ceiling layer to produce said working gap (column 6, lines 8-10).

In re claim 2, the step of providing at least one access hole leading to said sacrificial layer; and etching said sacrificial layer through said at least one access hole (column 6, lines 5-9).

In re claims 20-22, the fabrication of a device on the substrate that allows fluid transfer between working gap and device (column 7, lines 5-12; fig. 6) and is fabricated in a process compatible with the process of forming a working gap (column 6, 36-38, 62-63).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-4, 27, 28, 30, 31-32, 35, 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. (6,136,212) as applied to claim 1 above, and further in view of Lin et al. (5,591,139).

Mastrangelo et al fails to disclose an access hole formed through the ceiling layer to sacrificial layer and a sealing layer deposited over the ceiling layer to close said access hole. Mastrangelo et al also fails to disclose the etching of the sacrificial layer using tetramethyl ammonium hydroxide.

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Lin et al disclose an access hole formed through the ceiling layer to sacrificial layer (column 6, lines 8-11) and a sealing layer deposited over the ceiling layer to close said access hole (column 6, lines 40-43). Lin et al also discloses the etchant comprising tetramethyl ammonium hydroxide (column 5, lines 57-64).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al to form an access hole in the ceiling layer and to deposit a sealing layer on ceiling layer in order to close the access hole as taught by Lin et al because the formation of the access holes through the ceiling layer are easier to seal and the sealing layer is needed to seal the access hole openings in order to fabricate a sealed device.

Claim 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. (6,136,212) as applied to claim 1 above, and further in view of Mastrangelo (5,258,097).

Mastrangelo et al fails to disclose the multiplicity of holes extending through said sacrificial layer to said floor layer; the depositing of the ceiling layer in said multiplicity of holes to define obstacles in said working gap; and the removal of said sacrificial layer between said obstacles in said working gap to produce an artificial gel.

Mastrangelo discloses the multiplicity of holes extending through said sacrificial layer to said floor layer (column 4, lines 9-17); the depositing of the ceiling layer in said multiplicity of holes to define obstacles in said working gap (column 2, lines 21-30; column 4, lines 35-53); and the removal of said sacrificial between said obstacles in said working gap to produce an artificial gel (column 5, lines 46-50).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al. to form a multiplicity of holes extending through said sacrificial layer, deposit the ceiling layer in the holes to define obstacles, and to etch the sacrificial layer between these obstacles as taught by Mastrangelo in order to provide structural support for the ceiling layer against capillary forces.

Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. (6,136,212) in view of Frazier (5,871,158).

Mastrangelo et al. disclose a method comprising the steps of: depositing a floor layer on the top surface of a substrate (column 5, lines 57-66); depositing a sacrificial layer on the top surface of said floor layer (column 5, line 67-column 6, line 3); patterning said sacrificial layer to define in the sacrificial layer the shape of a desired fluid working gap (column 5, line 67-column 6, line 3); depositing a ceiling layer to cover said sacrificial layer (column 6, lines 3-5); providing at least one access hole leading to said sacrificial layer; and etching said sacrificial layer through said at least one access hole (column 6, lines 5-9) to produce said working gap (column 6, lines 8-10).

Mastrangelo et al. fail to disclose the addition of a patterned sacrificial layer, a second ceiling layer, and the removal of the sacrificial layers to produce multilevel working gaps.

Frazier discloses the formation of working gaps on multiple levels (figure 8; column 7, lines 30-41)

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al to form multilevel

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working gaps as taught by Frazier to allow different fluids to flow through different channels. Furthermore, the duplication of a prior art process to accomplish an expected additive function or result is prima facie obvious absent a disclosure that the process is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. See, for example, *In re Ockert*, 114 USPQ 330 (CCPA 1957); *In re Schuelke*, 96 USPQ 421 (CCPA 1953); *In re Hertrich*, 73 USPQ 442 (CCPA 1947); *Long Mfg. N.C., Inc. v. Condec Corp.*, 223 USPQ 1213 (DC ENC 1984); *St. Regis Paper Company v. Bemis Company, Inc.*, 193 USPQ 8 (CA 7 1977); *Hofschneider Corp. v. Lane et al.*, doing business as Lane and Co., 71 USPQ 126 (DC WNY 1946).

Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. (6,136,212) as applied to claim 9 above, and further in view of Lin et al. (5,591,139).

Mastrangelo et al, as modified, disclose the method of forming a multilevel fluidic device and the depositing of a sealing layer over said second ceiling layer to close at least one access hole.

Mastrangelo et al fail to disclose the removing of sacrificial layers performed by etching all the sacrificial layers through at least one access hole formed in the ceiling layer, including the formation of the access hole through the topmost ceiling layer, leading to one of said sacrificial layers and at least one vertical connector hole that interconnects adjacent sacrificial layers. Mastrangelo as fails to disclose the depositing of a sealing layer over said second ceiling layer to close at least one access hole.

Lin et al disclose the removing of a sacrificial layer performed by etching the sacrificial layer through at least one access hole (column 6, lines 8-11), including the

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formation of the access hole through the topmost ceiling layer, leading to one of said sacrificial layers and at least one vertical connector hole that interconnects adjacent sacrificial layers (column 6, lines 8-11).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the method of Mastrangelo et al, as modified in claim 9, in order to form the access holes and vertical connector hole and to etch away the sacrificial layers as taught by Lin et al because the formation of the access holes through the ceiling layer are easier to seal and they provide access to the sacrificial layer. Furthermore, the duplication of a prior art process to accomplish a multilevel structure that would have access holes formed in every ceiling layer thus deposited would have been obvious to one of ordinary skill in the art at the time the invention was made.

Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. as applied to claim 9 above, and further in view of Mastrangelo (5,258,097).

Mastrangelo et al as modified fail to disclose the multiplicity of holes extending through a corresponding sacrificial layer; the depositing of the ceiling layer in said multiplicity of holes to define obstacles in said working gap; and the removal of said sacrificial between said obstacles in at least one working gap to produce an artificial gel.

Mastrangelo discloses the multiplicity of holes extending through a corresponding sacrificial layer (column 4, lines 9-17); the depositing of the ceiling layer in said multiplicity of holes to define obstacles in said working gap (column 2, lines 21-30; column 4, lines 35-53); and the removal of said sacrificial between said obstacles in at least one working gap to produce an artificial gel (column 5, lines 46-50).

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Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al. to form a multiplicity of holes extending through said sacrificial layer, deposit the ceiling layer in the holes to define obstacles, and to etch the sacrificial layer between these obstacles as taught by Mastrangelo in order to provide structural support for the ceiling layer against capillary forces.

Claims 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. as applied to claim 31, and further in view of Tai et al. (6,146,543).

Mastrangelo et al as modified fails to disclose the ceiling layer comprising a dielectric material and the sacrificial layer comprising amorphous silicon or polysilicon.

Tai et al. disclose the ceiling layer comprising a dielectric material and the sacrificial layer comprising polysilicon (column 4, lines 17-33).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the ceiling and sacrificial layers of Mastrangelo et al to make the ceiling layer out of a dielectric material and the sacrificial layer out of polysilicon as taught by Tai et al in order to have a high fracture strain, low modulus material for the ceiling layer and to have a sacrificial layer that has a etch high selectivity over the ceiling layer when TMAH is used. It also would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute amorphous silicon for polysilicon, as these materials are alternatives for use as a sacrificial material.

Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al as applied to claim 30 above, and further in view of Frazier (5,871,158).

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Mastrangelo et al as modified fails to disclose the forming of further fluidic devices on top of the already formed fluidic systems and forming interconnects therebetween.

Frazier discloses the forming of further fluidic devices on top of the already formed fluidic systems and forming interconnects therebetween (column 7, lines 2-8, 30-41).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al to form multilevel working gaps as taught by Frazier to allow different fluids to flow through different channels. Furthermore, the duplication of a prior art process to accomplish an expected additive function or result is prima facie obvious absent a disclosure that the process is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. See, for example, *In re Ockert*, 114 USPQ 330 (CCPA 1957); *In re Schuelke*, 96 USPQ 421 (CCPA 1953); *In re Hertrich*, 73 USPQ 442 (CCPA 1947); *Long Mfg. N.C., Inc. v. Condec Corp.*, 223 USPQ 1213 (DC ENC 1984); *St. Regis Paper Company v. Bemis Company, Inc.*, 193 USPQ 8 (CA 7 1977); *Hofschneider Corp. v. Lane et al.*, doing business as Lane and Co., 71 USPQ 126 (DC WNY 1946).

Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al as applied to claim 30 above, and further in view of Vaeth (US2001/0005527).

Mastrangelo et al as modified fails to disclose the layers being formed using chemical vapor deposition.

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Vaeth discloses the layers being formed using chemical vapor deposition (paragraph 9).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al to form the layers using chemical vapor deposition as taught by Vaeth in order to use a method that produces a relatively thin polymer layer with no holes therein.

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mastrangelo et al. (6,136,212) in view of Lin et al. (5,591,139) and further in view of Nakagima et al. (4,698,407).

Mastrangelo et al disclose a method comprising the steps of: depositing a sacrificial layer on a substrate (column 5, line 67-column 6, line 1); lithographically patterning the sacrificial layer (column 6, lines 1-3); depositing a ceiling layer on the patterned sacrificial layer (column 6, lines 3-5); forming access holes (column 6, lines 5-7); etching the patterned sacrificial layer via the access holes (column 6, lines 8-9).

Mastrangelo et al fails to disclose the formation of the access holes through the ceiling layer and the oxidation of the access holes.

Lin et al disclose the formation of access holes through the ceiling layer (column 6, lines 1-11).

Nakagima et al disclose the oxidation access holes (column 1, lines 15-21).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Mastrangelo et al to form the access hole through the ceiling layer as taught by Lin et al and to oxidize the access holes as taught by Nakagima et al because the formation of the access holes through the ceiling

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layer are easier to seal and the oxidation of the access holes are needed to seal the access hole openings in order to fabricate a sealed device.

Allowable Subject Matter

Claim 24 is allowed. None of the references of record teach or suggest a method wherein a patterned silicon sacrificial wire is oxidized to form a silicon oxide coating and the etching of the sacrificial wire to produce a nanochannel.

Claims 8 and 19 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. None of the references of record teach the forming of a ridge waveguide in the ceiling layer that intersects the location of a desired fluid working gap.

Claim 23 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Judith A. Cothorn whose telephone number is 703-305-4733. The examiner can normally be reached on Mon-Fri, 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

A handwritten signature in black ink, appearing to be 'Mary Wilczewski', written in a cursive style.

jac
August 26, 2002

Mary Wilczewski
Primary Examiner